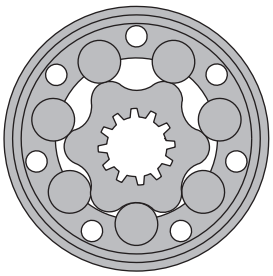
HYDRAULIC MOTORS MH

APPLICATION

» Conveyors
» Feeding mechanism of robots and manipulators
» Metal working machines
» Textile machines
» Agricultural machines
» Food industries
» Mining machinery etc.



CONTENTS

OPTIONS

» Model - Spool valve, roll-gerotor
» Flange mount
» Shafts - straight, splined and tapered
» Metric and BSPP ports
» Other special features

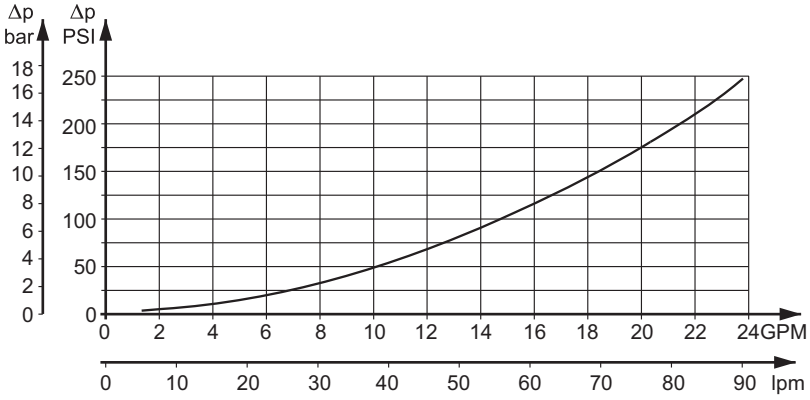
GENERAL

Max. Displacement, cm^3/rev [in^3/rev]	502,4 [30.7]
Max. Speed, [RPM]	445
Max. Torque, daNm [lb-in]	cont.: 84 [7434] int.: 104 [9204]
Max. Output, kW [HP]	18,5 [24.8]
Max. Pressure Drop, bar [PSI]	cont.: 175 [2540] int.: 200 [2900]
Max. Oil Flow, lpm [GPM]	90 [23.78]
Min. Speed, [RPM]	5
Pressure fluid	Mineral based- HLP(DIN 51524) or HM(ISO 6743/4)
Temperature range, ^{O}C [^{O}F]	-40÷140 [-40÷284]
Optimal Viscosity range, mm^2/s [SUS]	20÷75 [98÷347]
Filtration	ISO code: 18/16/13 According to ISO 4406-1999

Oil flow in drain line

Pressure drop bar [PSI]	Viscosity mm^2/s [SUS]	Oil flow in drain line lpm [GPM]
100 [1450]	20 [98]	2,5 [.660]
	35 [164]	1,8 [.476]
140 [2030]	20 [98]	3,5 [.925]
	35 [164]	2,8 [.740]

Pressure Losses



SPECIFICATION DATA

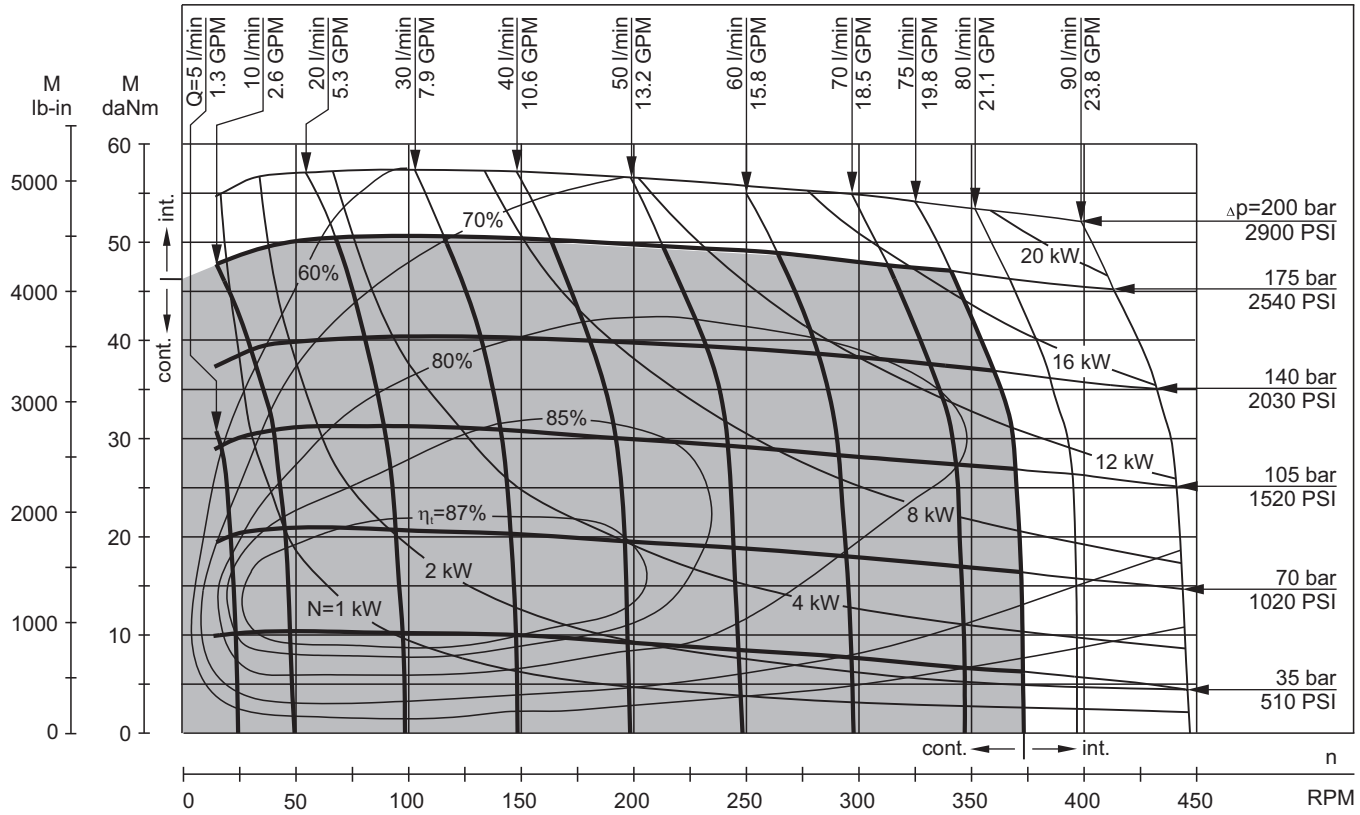
Type		MH 200	MH 250	MH 315	MH 400	MH 500
Displacement, cm³/rev [in³/rev]		201,3 [12.3]	252 [15.4]	314,9 [19.2]	396,8 [24.2]	502,4 [30.7]
Max. Speed,	Cont.	370	295	235	185	150
[RPM]	Int.*	445	350	285	225	180
Max. Torque	Cont.	51 [4510]	61 [5398]	74 [6548]	84 [7434]	82 [7257]
daNm [lb-in]	Int.*	58 [5130]	70 [6195]	82 [7257]	98 [8673]	104 [9204]
	Peak**	64 [5064]	79 [6992]	98 [8673]	109 [9647]	117 [10350]
Max. Output	Cont.	16 [21]	16 [21]	14 [18.7]	12,5 [16.7]	11 [14.7]
kW [HP]	Int.*	18,5 [24.8]	18,5 [24.8]	15,5 [20.7]	15 [20.1]	14 [18.7]
Max. Pressure	Cont.	175 [2540]	175 [2540]	175 [2540]	155 [2240]	125 [1810]
Drop	Int.*	200 [2900]	200 [2900]	200 [2900]	190 [2750]	160 [2320]
bar [PSI]	Peak**	225 [3260]	225 [3260]	225 [3260]	210 [3045]	180 [2610]
Max. Oil Flow	Cont.	75 [19.81]	75 [19.81]	75 [19.81]	75 [19.81]	75 [19.81]
lpm [GPM]	Int.*	90 [23.78]	90 [23.78]	90 [23.78]	90 [23.78]	90 [23.78]
Max. Inlet Pressure	Cont.	200 [2900]	200 [2900]	200 [2900]	200 [2900]	200 [2900]
bar [PSI]	Int.*	225 [3260]	225 [3260]	225 [3260]	225 [3260]	225 [3260]
	Peak**	250 [3626]	250 [3626]	250 [3626]	250 [3626]	250 [3626]
Max. Starting Pressure with Unloaded Shaft, bar [PSI]		5 [72]	5 [72]	5 [72]	5 [72]	5 [72]
Min. Starting Torque,	At max.press.dropCont	39 [3450]	52 [4600]	66 [5840]	72 [6370]	72 [6370]
daNm [lb-in]	At max.press.drop Int.*	45 [3980]	59 [5221]	73 [6460]	88 [7788]	88 [7788]
Min. Speed*, [RPM]**		10	10	8	5	5
Weight, kg [lb]		10,5 [23.2]	11 [24.3]	11,5 [25.4]	12,3 [27.1]	13 [28.7]

* Intermittent operation: the permissible values may occur for max. 10% of every minute.
** Peak load: the permissible values may occur for max. 1% of every minute.
*** For speeds lower than given, consult factory or your regional manager.

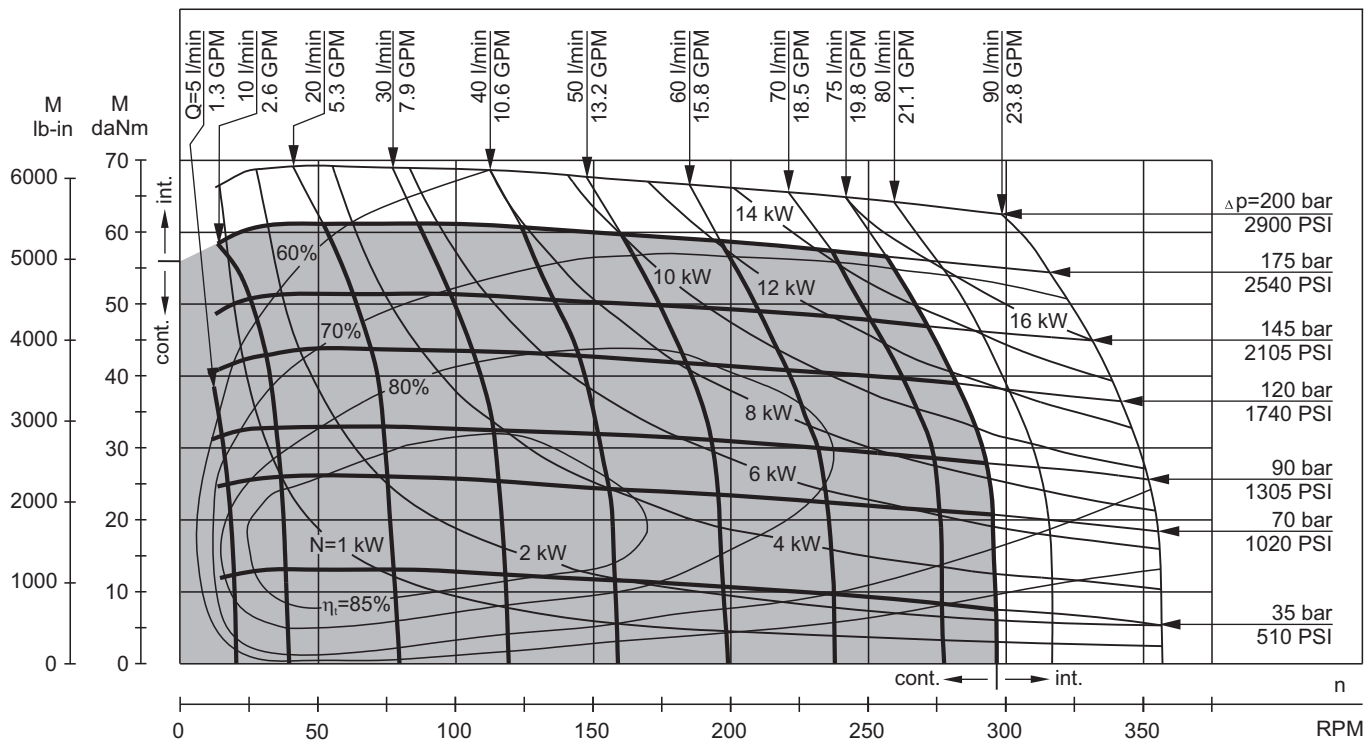
1. Intermittent speed and intermittent pressure must not occur simultaneously.
2. Recommended filtration is per ISO cleanliness code 20/16. A nominal filtration of 25 micron or better.
3. Recommend using a premium quality, anti-wear type mineral based hydraulic oil HLP(DIN51524) or HM (ISO 6743/4). If using synthetic fluids consult the factory for alternative seal materials.
4. Recommended minimum oil viscosity 13 mm²/s [70 SUS] at 50°C [122°F].
5. Recommended maximum system operating temperature is 82°C [180°F].
6. To assure optimum motor life fill with fluid prior to loading and run at moderate load and speed for 10-15 minutes.

FUNCTION DIAGRAMS

MH 200



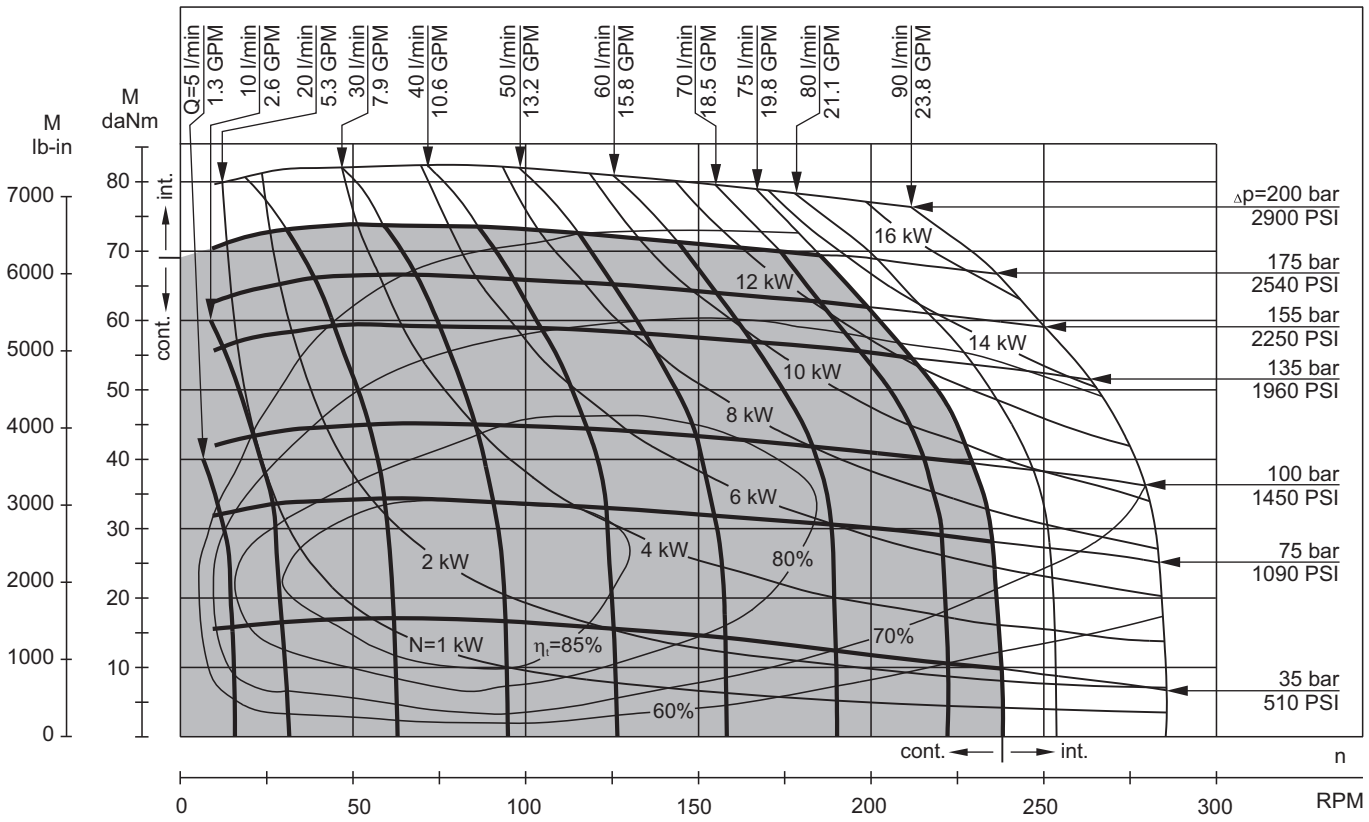
MH 250



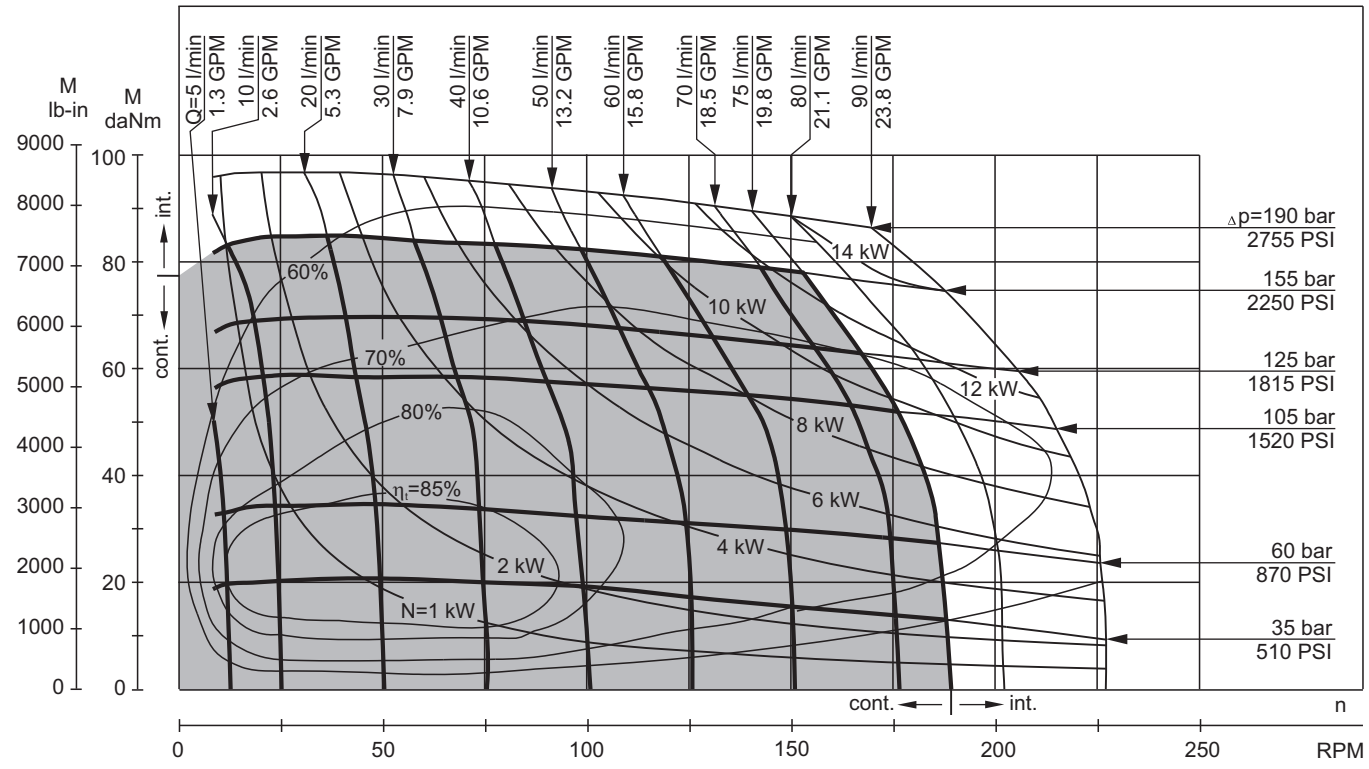
The function diagrams data is for average performance of randomly selected motors at back pressure 5÷10 bar [72.5÷145 PSI] and oil with viscosity of 32 mm²/s [150 SUS] at 50°C [122°F].

FUNCTION DIAGRAMS

MH 315



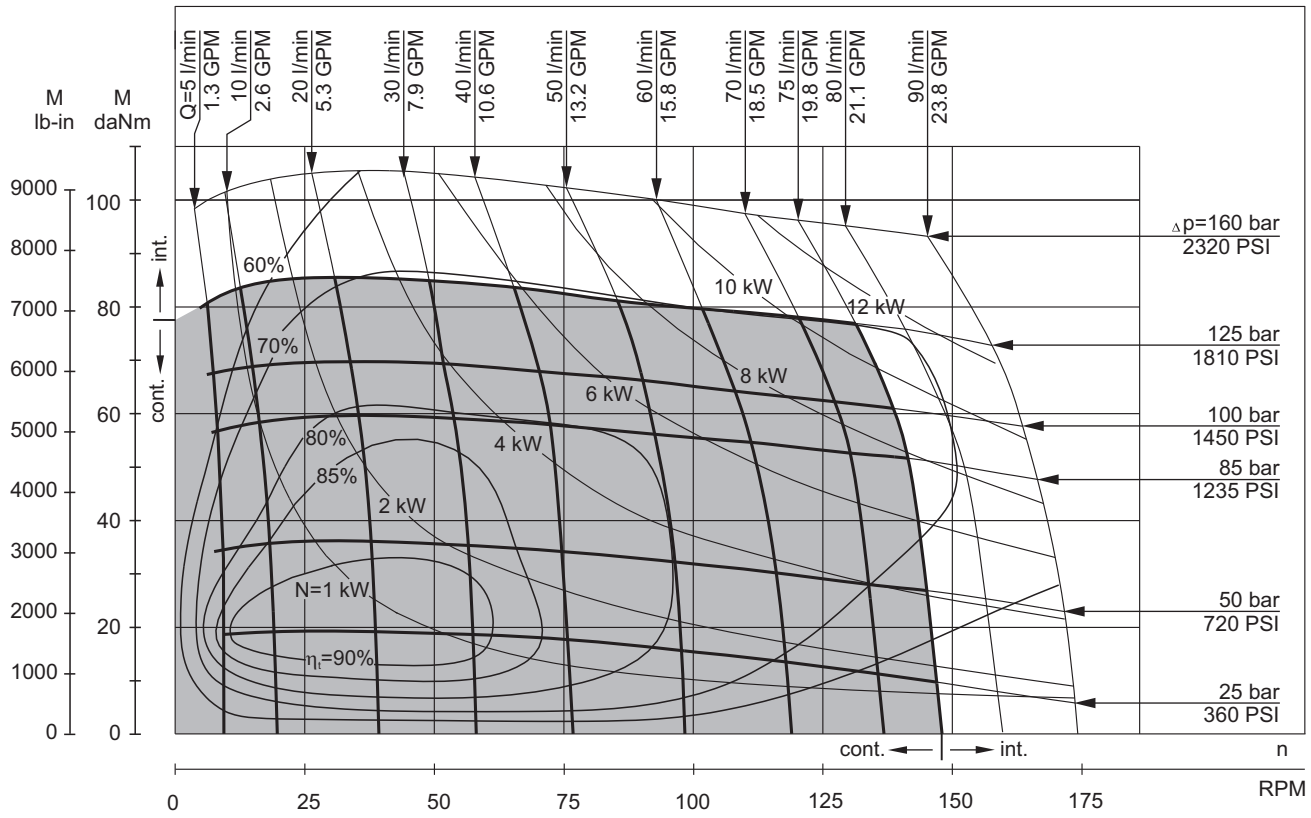
MH 400



The function diagrams data is for average performance of randomly selected motors at back pressure 5÷10 bar [72.5÷145 PSI] and oil with viscosity of 32 mm²/s [150 SUS] at 50°C [122°F].

FUNCTION DIAGRAMS

MH 500



The function diagrams data is for average performance of randomly selected motors at back pressure 5÷10 bar [72.5÷145 PSI] and oil with viscosity of 32 mm²/s [150 SUS] at 50°C [122°F].

PERMISSIBLE SHAFT LOADS FOR MH MOTORS

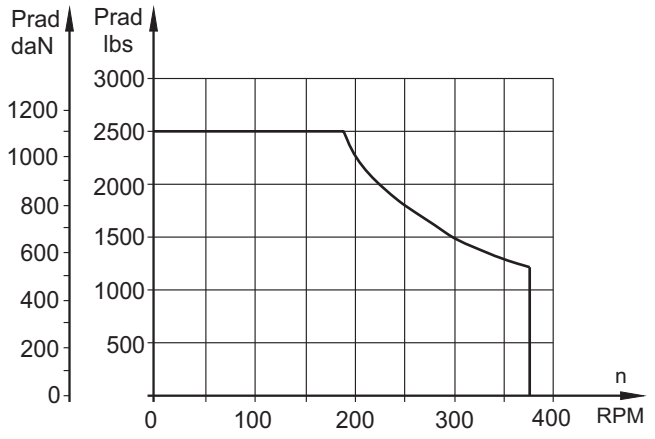
The permissible radial shaft load P_{rad} depends on the speed (RPM) and distance (L) from the point of load to the mounting flange.

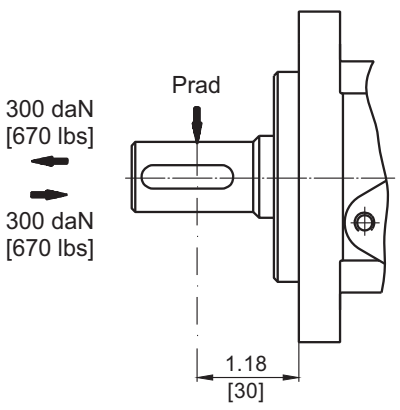
$$\text{Radial Shaft Load } P_{rad} = \frac{1100}{n} \times \frac{25000}{103{,}5+L}, \text{ daN*}$$

[*L in mm; L≤60 mm; n≥200 RPM]

$$\text{Radial Shaft Load } P_{rad} = \frac{1100}{RPM} \times \frac{2215}{4.075+L}, \text{ lbs**}$$

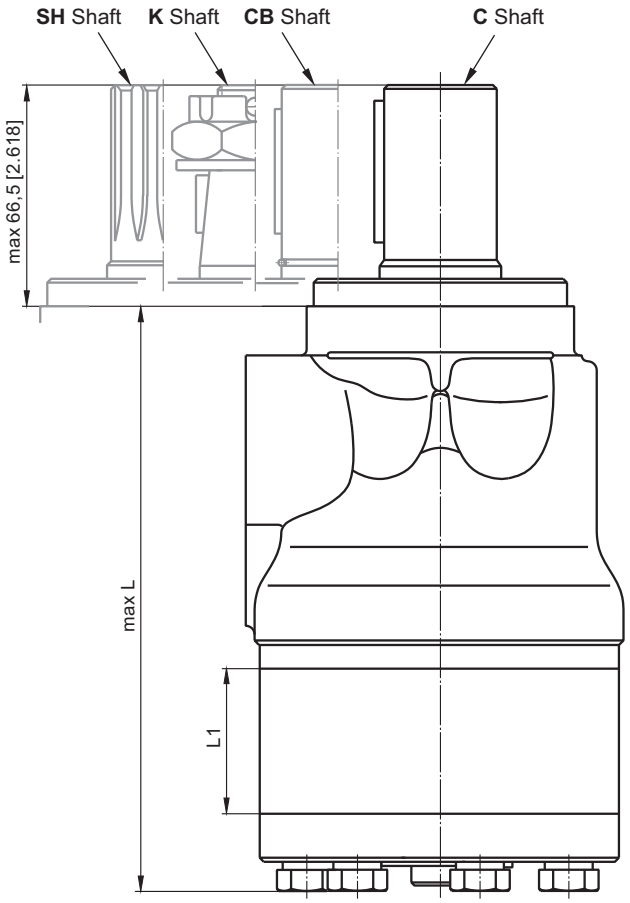
[**L in inch; L≤2.36 in; n≥200 RPM]

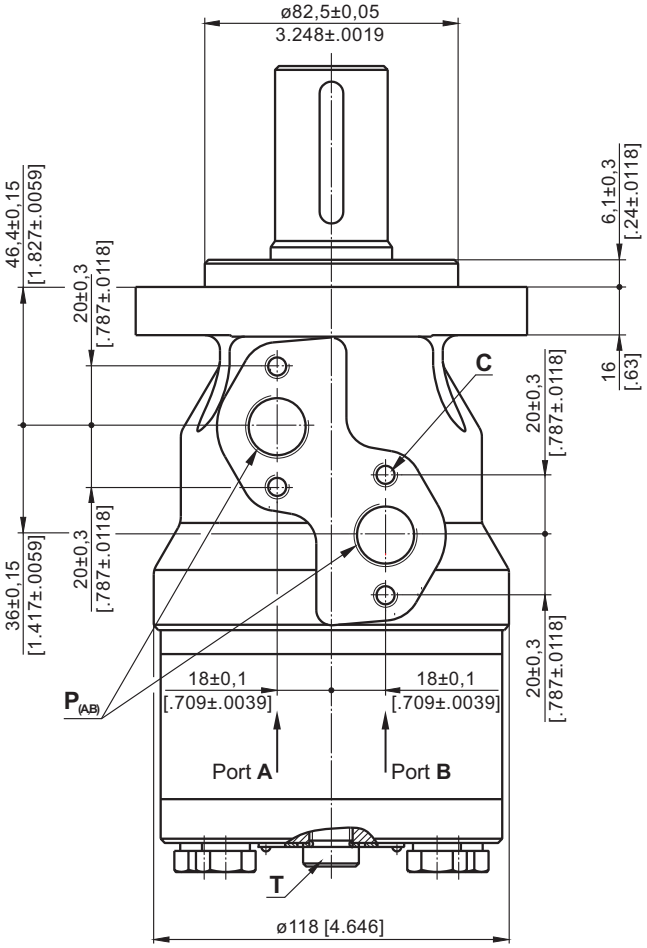


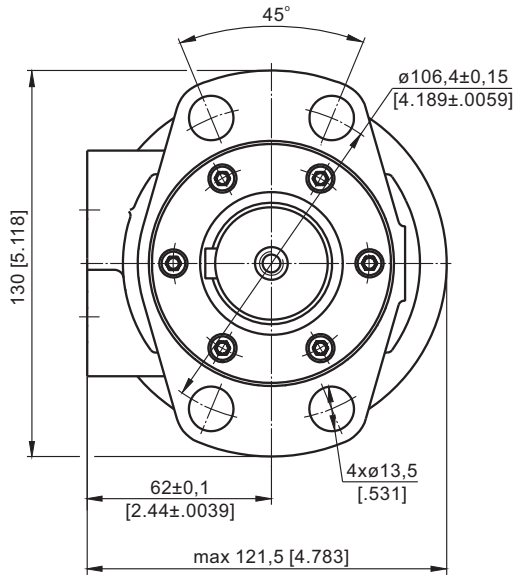


DIMENSIONS AND MOUNTING DATA

Magneto Mount (4 holes)







Type	L, mm [in]	L_1, mm [in]
MH 200	169 [6.65]	27,8 [1.09]
MH 250	176 [6.93]	34,8 [1.37]
MH 315	184 [7.24]	43,5 [1.71]
MH 400	196 [7.72]	54,8 [2.16]
MH 500	211 [8.31]	69,4 [2.73]

C : 4xM8-13 mm [.51 in] depth
$P_{(A, B)}$: 2xG1/2 or 2xM22x1,5-15 mm [.59 in] depth
T : G1/4 or M14x1,5-12 mm [.47 in] depth (plugged)

Standard Rotation
Viewed from Shaft End
Port **A** Pressurized - **CW**
Port **B** Pressurized - **CCW**

Reverse Rotation
Viewed from Shaft End
Port **A** Pressurized - **CCW**
Port **B** Pressurized - **CW**

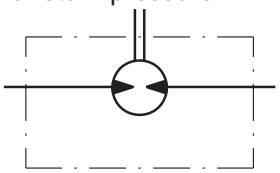
mm [in]

MAX. PERMISSIBLE SHAFT SEAL PRESSURE FOR MH MOTORS

MH...U1 motors with high pressure seal and without drain connection:

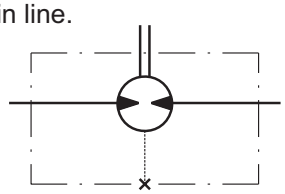
The shaft seal pressure equals the average of input pressure and return pressure.

$$P_{seal} = \frac{P_{input} + P_{return}}{2}$$



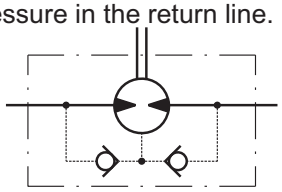
MH...U motors with high pressure seal and drain connection:

The shaft seal pressure equals the pressure in the drain line.



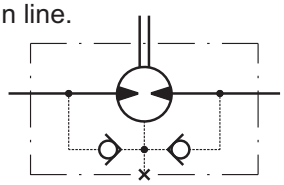
MH...1 motors with standard shaft seal and without drain connection:

The shaft seal pressure never exceeds the pressure in the return line.

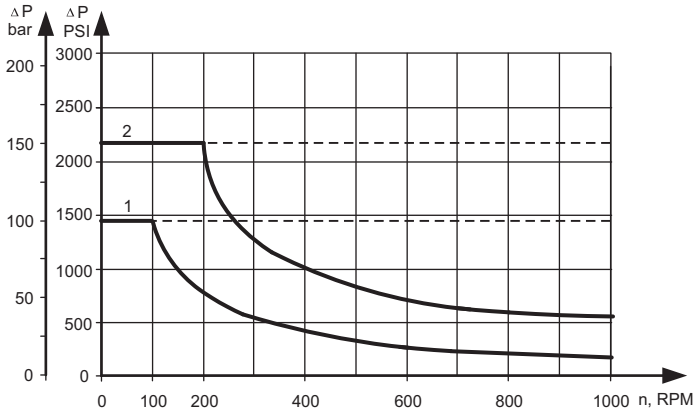


MH... motors with standard shaft seal and with drain connection:

The shaft seal pressure equals the pressure in the drain line.



Max. return pressure without drain line or max. pressure in the drain line



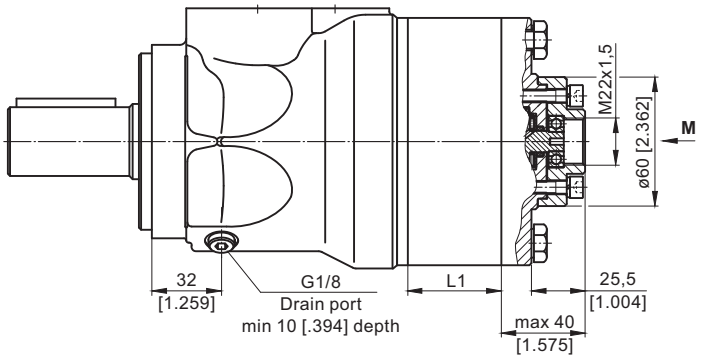
1: Drawing for Standard Shaft Seal

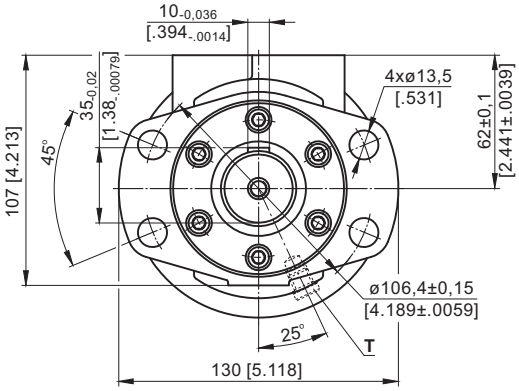
2: Drawing for High Pressure Seal ("**U**" Seal)

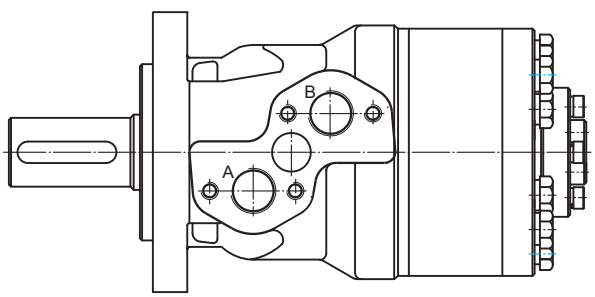
——— - continuous operations

- - - - - - intermittent operations

MOTORS WITH TACHO CONNECTION

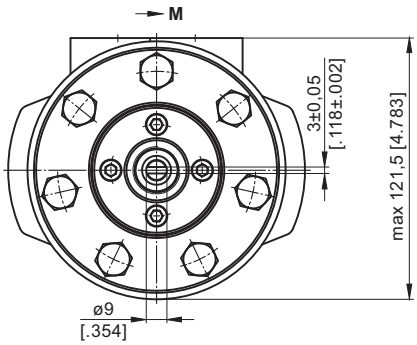






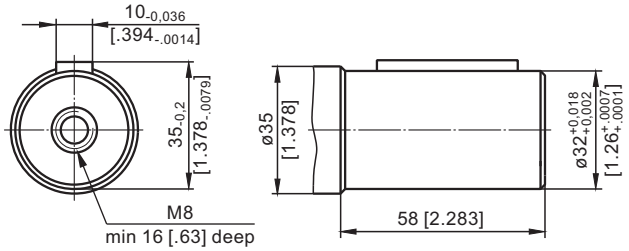
mm [in]

Type	L, mm [in]	L_1, mm [in]
MH 200	191 [7.52]	27,8 [1.09]
MH 250	198 [7.79]	34,8 [1.37]
MH 315	207 [8.15]	43,5 [1.71]
MH 400	218 [8.58]	54,8 [2.16]
MH 500	233 [9.17]	69,4 [2.73]

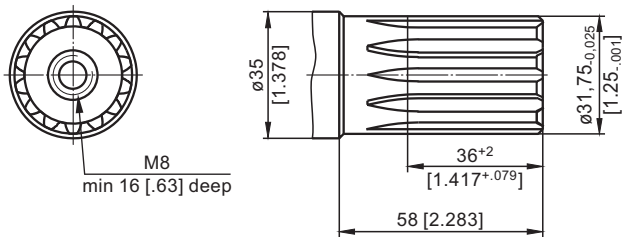


SHAFT EXTENSIONS

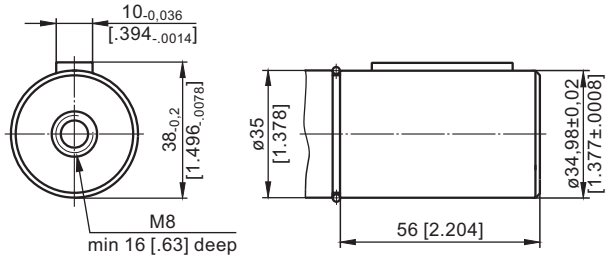
C - ø32 straight, Parallel key A10x8x45 DIN 6885
Max. Torque 77 daNm [6815 lb-in]



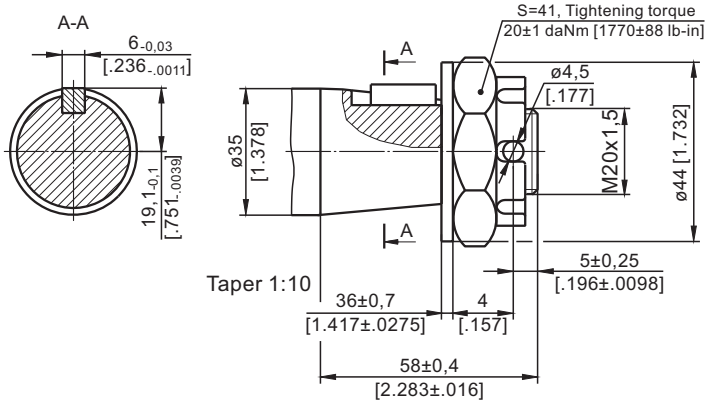
SH - ø1¼" splined 14T, DP 12/24 ANSI B92.1-1976
Max. Torque 95 daNm [8400 lb-in]



CB - ø35 straight, Parallel key A10x8x45 DIN 6885
Max. Torque 95 daNm [8400 lb-in]



K - tapered 1:10, Parallel key B6x6x20 DIN 6885
Max. Torque 95 daNm [8400 lb-in]



mm [in]

ORDER CODE

	1	2	3	4	5	6	7
M H							

Pos.1 - Displacement code*

200	- 201,3 cm³/rev [12.3 in³/rev]
250	- 252,0 cm³/rev [15.4 in³/rev]
315	- 314,9 cm³/rev [16.4 in³/rev]
400	- 396,8 cm³/rev [24.2 in³/rev]
500	- 502,4 cm³/rev [30.7 in³/rev]

Pos.3 - Shaft Extensions*

C	- ø32 straight, Parallel key A10x8x45 DIN6885
SH	- ø1¼" splined 14T ANSI B92.1-1970
CB**	- ø35 straight, Parallel key A10x8x45 DIN6885
K	- ø35 tapered 1:10, Parallel key B6x6x20 DIN6885

Pos.3 - Shaft Seal Version

omit	- Standard shaft seal
U	- High pressure shaft seal (without check valves)

Pos.4 - Drain Port

omit	- with drain port
1	- without drain port

Pos.5 - Ports

omit	- BSPP (ISO 228)
M	- Metric (ISO 262)

Pos.6 - Special Features (see page 120)

Pos.7 - Design Series

omit - Factory specified

NOTES: * The permissible output torque for shafts must not be exceeded!
** The following combination is not allowed: "**CB**" shaft with **U** shaft seal.

The hydraulic motors are mangano-phosphatized as standard.

MOTOR SPECIAL FEATURES

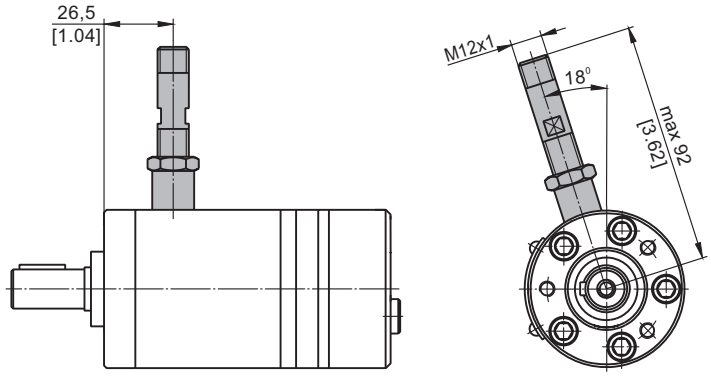
Special Feature Description	Order Code	Motor type														
		MM	MP	MPW	MP(W)N	MR	MRN	MRB	SP, SR	PL	RL	PK(Q)	RK	RW	MH	HW
Speed Sensor*	RS	O	O	-	-	O	-	-	-	-	-	-	-	-	O	O*****
Tacho connection	T	-	-	-	-	O	O	-	-	-	-	-	-	-	O	-
Low Leakage	LL	O	-	-	-	O	O	-	-	-	O	-	O	O	O	O
Low Speed Valving	LSV	-	-	-	-	O	-	-	-	-	-	-	-	-	O	O
Free Running	FR	O	O	O	O	O	O	-	-	O	O	O	O	O	O	O
Reverse Rotation	R	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Paint**	P	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Corrosion Protected Paint**	PC	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Special Paint***	PS	O	O	O	O	O	O	O	-	O	O	O	O	O	O	O
	PCS															
Check Valves		S	S****	S****	S	S****	S	S	S	S	S	S	S	S****	S****	S

O	Optional
-	Not applicable
S	Standard

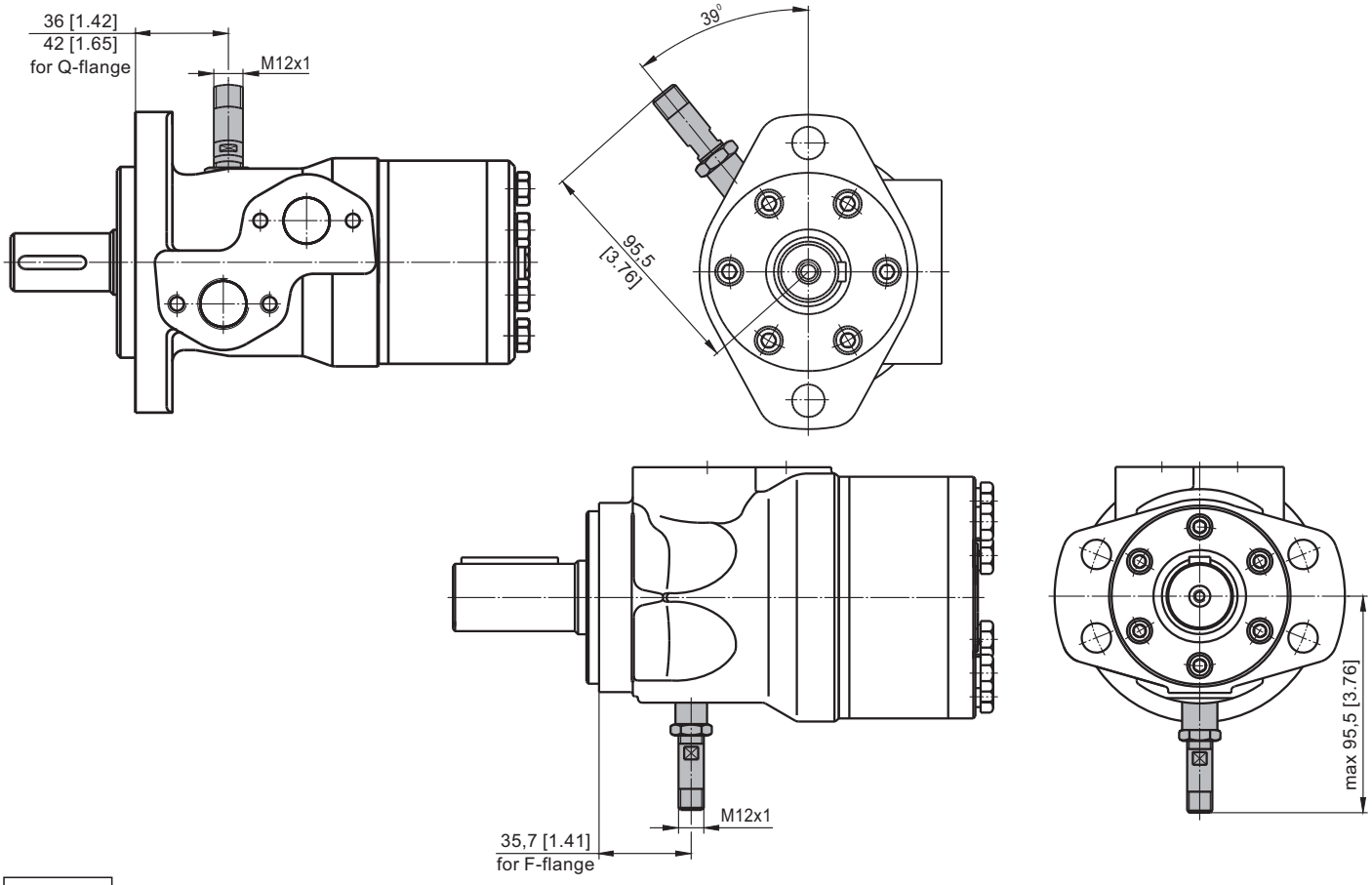
* For sensor ordering see pages 121÷122.
** Colour at customer's request.
*** Non painted feeding surfaces, colour at customer's request.
**** Without check valves for "**U**" shaft seal versions.
***** RS option is not available at HW...R (with relief valves).

MOTORS WITH SPEED SENSOR

MM...RS

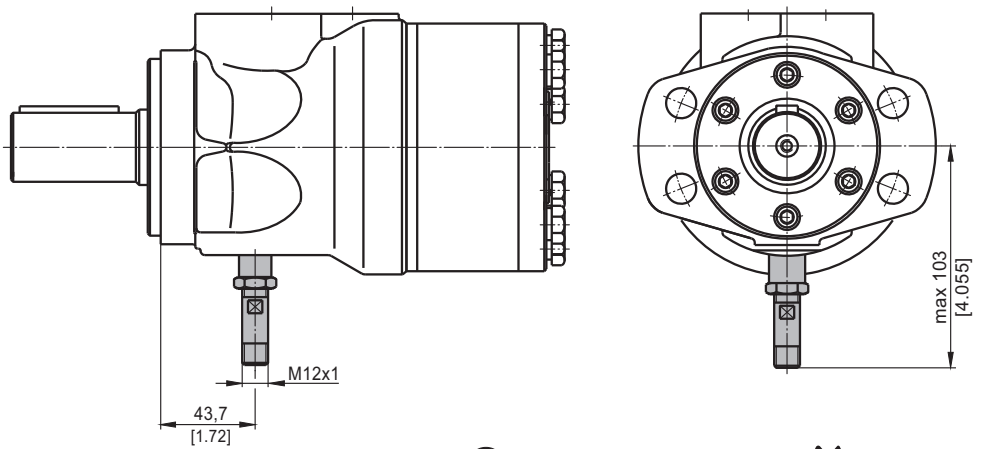


MP...RS and MR...RS

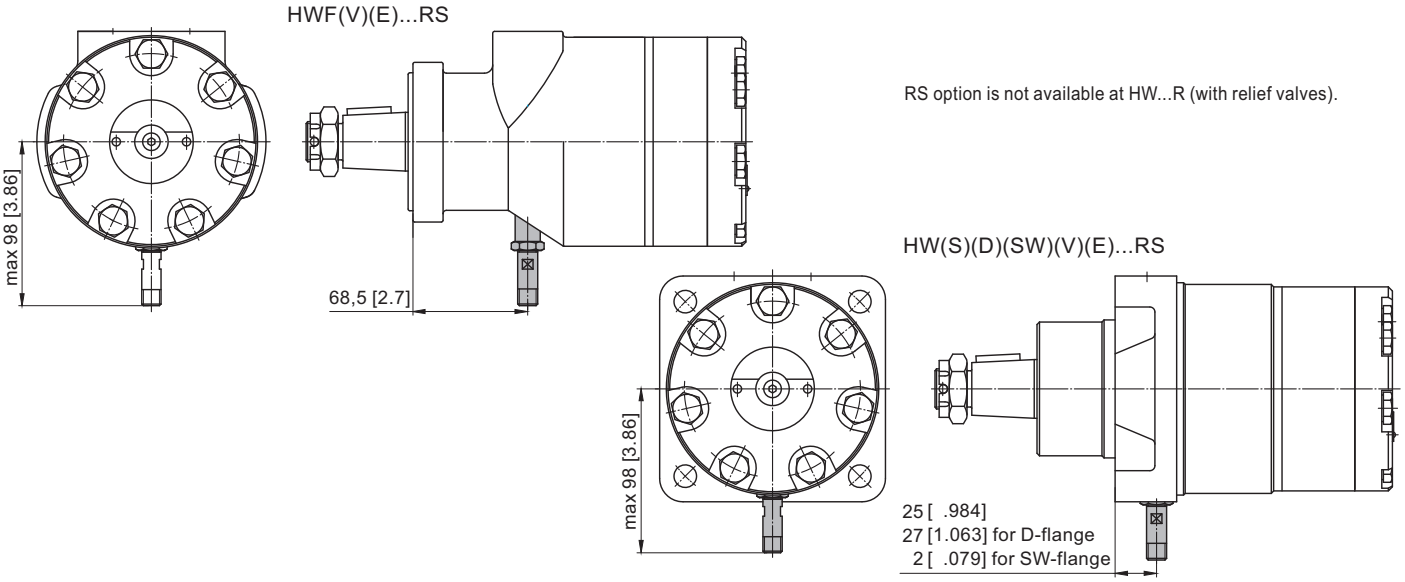


mm [in]

MH...RS



HW...RS

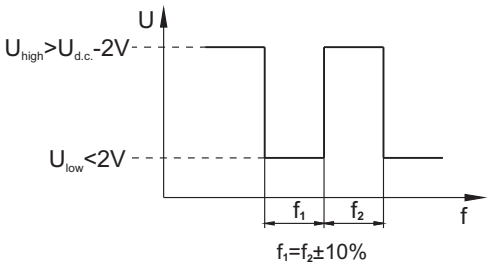


TECHNICAL DATA OF THE SPEED SENSOR

Technical data

Frequency range	0...15 000 Hz
Output	Universal PUSH PULL
Power supply	10-30 VDC
Current input	<20 mA (@24 VDC)
Maximum output current	500 mA
Ambient Temperature	-40...+125^{0}C [-40...+257^{0}F]
Protection	IP 67
Plug connector	M12-Series
Mounting principle	ISO 6149

Output signal

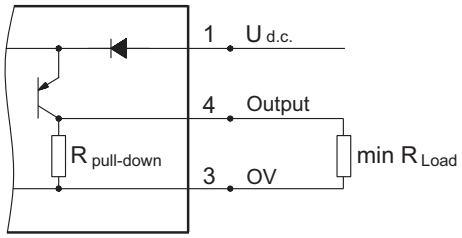


Load max.:$I_{high}=I_{low}$<50mA

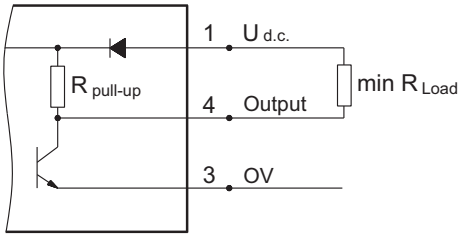
Motor type	MM	MP	MR	MH	HW
Pulses per revolution	30	36	36	42	12

Wiring diagrams

PNP

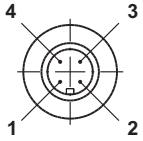


NPN



R_{Load} [kΩ]=$U_{d.c.}$ [V]/I_{max} [mA]

Stick type



Terminal No.	Connection	Cable Output
1	$U_{d.c.}$	Brown
2	No connection	White
3	0V	Blue
4	Output signal	Black

Order Code for Speed Sensor

Sensor Code	Electric connection
RS	Connector BINDER 713 series
RSL2,5	Cable output 3x0,25; 2,5 m [98 in] long
RSL3,5	Cable output 3x0,25; 3,5 m [138 in] long
RSL5	Cable output 3x0,25; 5 m [196 in] long
RSL10	Cable output 3x0,25; 10 m [394 in] long

NOTE: * - The speed sensor is not fitted at the factory, but is supplied in a plastic bag with the motor. For installation see enclosed instructions.

APPLICATION CALCULATION

VEHICLE DRIVE CALCULATIONS

1. Motor speed: n [RPM]

$$n=\frac{2.65 \times V_{km} \times i}{R_m} \qquad n=\frac{2168 \times V_{mi} \times i}{R_{in}}$$

$\mathbf{v_{km}}$ - vehicle speed, km/h;
$\mathbf{v_{mi}}$ - vehicle speed, mil/h;
$\mathbf{R_m}$ - wheel rolling radius, m;
$\mathbf{R_{in}}$ - wheel rolling radius, in;
i - gear ratio between motor and wheels. If no gearbox, use i=1.

2. Rolling resistance: RR, daN [lbs]

The resistance force resulted in wheels contact with different surfaces:

$$RR=G \times \rho$$

G - total weight loaded on vehicle, daN [lbs];
ρ - rolling resistance coefficient (Table 1).

Table 1

Rolling resistance coefficient In case of rubber tire rolling on different surfaces	
Surface	ρ
Concrete- faultless	0.010
Concrete- good	0.015
Concrete- bad	0.020
Asphalt- faultless	0.012
Asphalt- good	0.017
Asphalt- bad	0.022
Macadam- faultless	0.015
Macadam- good	0.022
Macadam- bad	0.037
Snow- 5 cm	0.025
Snow- 10 cm	0.037
Polluted covering- smooth	0.025
Polluted covering- sandy	0.040
Mud	0.037÷0.150
Sand- Gravel	0.060÷0.150
Sand- loose	0.160÷0.300

3. Grade resistance: GR, daN [lbs]

$$GR=G \times (\sin\alpha + \rho \times \cos\alpha)$$

α - gradient negotiation angle (Table 2).

Table 2

Grade %	α Degrees	Grade %	α Degrees
1%	0º 35'	12%	6º 5'
2%	1º 9'	15%	8º 31'
5%	2º 51'	20%	11º 19'
6%	3º 26'	25%	14º 3'
8%	4º 35'	32%	18º
10%	5º 43'	60%	31º

4. Accelerarion force: FA, daN [lbs]

Force **FA** necessary for acceleration from 0 to maximum speed **v** and time **t** can be calculated with a formula:

$$FA=\frac{V_{km} \times G}{36 \times t}, [daN] \qquad FA=\frac{V_{mi} \times G}{22 \times t}, [lbs]$$

R - acceleration force, daN [lbs];
t - time, [s]

5. Tractive effort: DP, daN [lbs]

Tractive effort **DP** is the additional force of trailer. This value will be established as follows:
- acc. to constructor's assessment;
- as calculating forces in items 2, 3 and 4 of trailer; the calculated sum corresponds to the tractive effort requested.

6. Total tractive effort: TE, daN [lbs]

Total tractive effort **TE** is total effort necessary for vehicle motion; that the sum of forces calculated in items from 2 to 5 and increased with 10% because of air resistance.

$$TE=1,1 \times (RR + GR + FA + DP)$$

RR - force acquired to overcome the rolling resistance;
GR - force acquired to slope upwards;
FA - force acquired to accelerate (acceleration force);
DP - additional tractive effort (trailer).

7. Motor Torque moment: M, daNm [lb-in]

Necessary torque moment for every hydraulic motor:

$$M=\frac{TE \times R_{in}\,[R_m]}{N \times i \times h_M}$$

N - motor numbers;
η_M - mechanical gear efficiency (if it is available).

8. Cohesion between tire and road covering: M_W, daNm [lb-in]

Necessary torque moment for every hydraulic motor:

$$M_W=\frac{M_W \times f \times R_{in}\,[R_m]}{I \times h_M}$$

To avoid wheel slipping, the following condition should be observed $M_W > M$

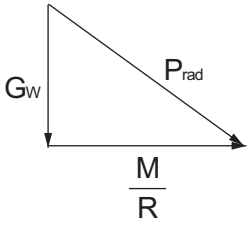
f - frictional factor;
$\mathbf{G_W}$ - total weight over the wheels, daN [lbs].

Table 3

Surface	Frictional factor f
Steel on steel	0.15 ÷ 0.20
Rubber tire on polluted surface	0.5 ÷ 0.7
Rubber tire on asphalt	0.8 ÷ 1.0
Rubber tire on concrete	0.8 ÷ 1.0
Rubber tire on grass	0.4

9. Radial motor loading: P_{rad}, daN [lbs]

When motor is used for vehicle motion with wheels mounted directly on motor shaft, the total radial loading of motor shaft Prad is a sum of motion force and weight force acting on one wheel.



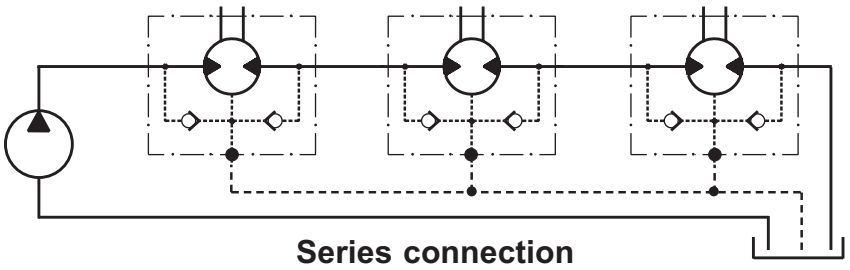
G_w - weight held by wheel;
P_{rad} - total radial loading of motor shaft;
M/R - motion force.

$$P_{rad}=\sqrt{G_w^2+\left(\frac{M}{R}\right)^2}$$

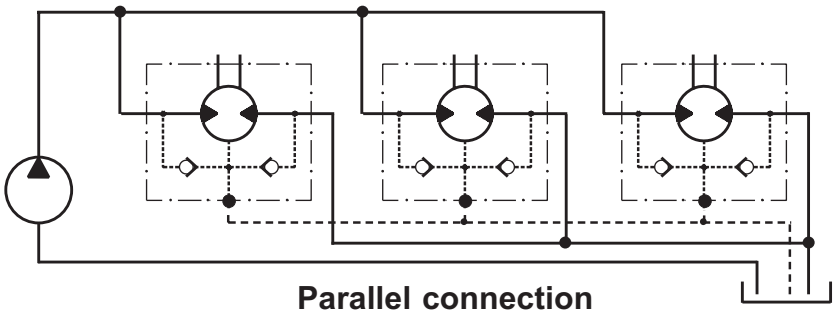
In accordance with calculated loadings the suitable motor from the catalogue is selected.

DRAINAGE SPACE AND DRAINAGE PRESSURE

Advantages in oil drainage from drain space: Cleaning; Cooling and Seal lifetime prolonging.



Series connection



Parallel connection